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Willingness to Pay for Forest Management: Experimental Economics Approach

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Abstract

The main objective of this study is to explore the major influential factors that affect the WTP of households to conserve the forest using the Tobit model. WTP is assessed without intervention and with the intervention of change in the level of deforestation and income with and without awareness creation of the households regarding the severe consequences of deforestation. The results of the two experiments are then compared using the experimental economics approach. In order to attain this objective, primary data was collected using a questionnaire and awareness creation for 100 randomly selected households who live in West Ethiopia, Oromia region, Suba Forest close to Menagesha- Suba Forest. Data were collected in two rounds. That is before and after awareness creation. The study comes up with a result that 92% of the respondents are willing to pay in both experiments whereas the rest 8% are not. The mean WTP is Br 22.11 in cash and Br50.21in labor. The mean willingness to pay of respondents increases as the level of trees decreases and as their income increases. However, awareness creation has no significant effect on their WTP. Age, income, and the total family size are significant variables affecting the mean WTP of households. Since age has an inverse relation, family size, and income have a direct relation with the mean WTP of households.

Keywords: WTP, forest, deforestation, experiment, willingness to pay

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Introduction

Forests play significant environmental and economic roles in the sustainability of life (Fekadu, 2015). Humans are dependent on natural resources and this dependence has an adverse effect on the environment. In developing countries like Ethiopia, the rapid population growth with incomparable lower economic growth and technological change resulted in increasing consumption of renewable natural resources in excess of its regenerative capacity (Kirkby, 1995).

Most forestry operations in Ethiopia are undertaken in the rural part of the country and the society generates income through firewood, charcoal, and gum collection. About 50% of forestry employment is generated by firewood production (EFAP, 1992). The major cause of deforestation in Ethiopia is the rapid growth of the population in the country which results in an increasing demand for crop plantation, grazing land, and demand for wood for fuel and construction (Badege, 2009). This is due to a lack of viable land use policy. Ethiopia's forest reference level submission to the UNFCCC (2016) also listed free livestock grazing, fuel wood collection, farmland expansion, land fires, population growth, insecure land tenure, and poor law enforcement as the major drivers of deforestation and forest degradation in Ethiopia. This deforestation resulted in negatively affecting climate change, global warming, soil erosion, floods, and endangering animal and tree species.

The factors which cause deforestation are categorized into economic, social, political, and institutional factors. Population growth and illiteracy levels fall into the social factors. But economic factors like low levels of employment opportunity and income generation schemes and poverty and institutional factors related to property rights are pointed out as the major causes of deforestation in Ethiopia (Terefe, 2003).

In order to secure this significant natural resource, the country practiced different forest and natural resource management systems in a different regime. During the 19th century, forest reservation management practices were traditionally undertaken by the Gada system participant elders, who are also responsible for the locally agreed rules and norms of resource use (Wakijira et al., 2013). At the time of Minilik II, the resource management system was centralized. Land becomes privatized in the 1940s during the Haileselassie regime and this limited people's access to forests

(Watson, 2013). During the Derg regime, forest management become further centralized but land ownership was nationalized (Mekonnen, 2000). After the EPRDF government came to the power, focused on poverty alleviation through more efforts to increase the productivity and efficiency of agriculture. At the local level, agricultural and development agents have focused on their responsibilities for agricultural and development activities and given less attention to natural forest conservation. Even if forests are legally owned by the state, they are utilized by the local communities with a lack of law enforcement (Watson, 2013).

Community-based forest management is becoming the main management technique used by governments around the world for enhancing the conservation and management of forest resources. (N.A. Chukwuone & C.E. Okorji, 2008). This new system of forest governance started in Ethiopia around the mid-1990s (Alemayehu and Nathalie, 2015). It launched with a formal agreement and benefit-sharing clause between the government and the local communities (Farm Africa, 2015).

Households' response to the participatory forest management system can be captured by their willingness to pay to restore forests. As a result, the study tries to assess the WTP of the households in the West-Showa zone, Menagesha –Suba forest using the Tobit model.

Statements of the problem and Objectives

Deforestation and the resulting environmental degradation are a major problem in Ethiopia. Forests in Ethiopia are declining both in size and quality. In the early 1950's forests used to cover 16% of the land area and then reduced to 3.6% in the early 1980s and further declined to 2.7% in the 1990s. The annual deforested area is estimated to be 163,600 ha. This results in the total forest cover being reduced from 40% to 3% over the past 20 years (Terefe, 2003). This portion of deforestation is almost equal to the size of the Northern European country, Sweden (Alemtsehay, 2010); 15.11 million ha cover of forests in 1990 lowered to 12.2 million ha in 2010. On average, the annual loss of forests is estimated to fall between 150,000 ha to 200,000 ha (FAO, 2010). If the traditional way of forest consumption in the country continues on this trend, 9 million ha of forest land will be deforested and degraded within the years between 2020 and 2030. And this will also count a 65% increment in annual fuel wood consumption (Fekadu, 2015).

Deforestation causes climate change, loss of biodiversity, degradation of soil, disruption of hydrological cycles, decertification, economic loss, and social conflicts. In addition to this, deforestation is claimed to be a key factor to combat climate change which is challenging food security, community livelihood, and sustainable development (Fekadu, 2015). It is more severe and has a huge impact on other natural resources like soil, climate, and wildlife (Terefe, 2003). Deterioration of fertility and moisture storage capacity of the soil resulted in low agricultural productivity (Fekadu, 2015).

Compared to the unquestionable importance of forests, deforestation is a crucial problem in Ethiopia. Menagesha – Suba state forest which is 40 Km away from Addis Ababa is found in West Ethiopia, Oromia region. 31% of the households in the area live inside the forest site. Their economy is based on agriculture but the high rate of land degradation leads to a low level of agricultural productivity. This drives the community to depend on the nearby forest and its products (Duguma et.al, 2009). The formerly protected area of Menagesha – Suba state forest used to be 9,248 ha. But due to settlements, farmland, and grazing areas, only 2,500 ha of the original forest is left (MOA, 2002).

Since humans are more responsible for deforestation, reserving the forests also can be achievable through communities' participation. The participation of the local community around the forest in natural resource management is very crucial for the conservation of forestry (ETFF, 2003). Related to this, there are different studies conducted so far in Ethiopia. Some of the researchers identified factors that contribute to deforestation and the willingness to pay to preserve community forests using cross-section data and contingent evaluation techniques (Tefera, 2006, Deginet, et al, 2016). Others used Probit and Tobit economic model in order to assess the perception of the communities towards forest preservation and their willingness to pay (Alem, 2012; Deressa, 2014) and used a qualitative method to identify the major factors affecting local people's participation in forest management.

These studies are static in nature and didn't come up with the mean willingness to pay to preserve forests using experimental approaches which enables us to capture the changeable economic behavior of households in such a way that the salient factors that contribute to the mean willingness to pay of households across different scenarios could be assessed. Therefore, this paper is designed

to capture the changeable behavior of the households or the extent of willingness to pay of the community towards reserving the forest in different intervention mechanisms and scenarios using an experimental approach in order to give directions for policy implication.

The general objective of the study is to find out factors that influence the willingness to pay of the households to conserve the forest and to experiment with WTP with various scenarios which are located in the West Showa zone, Menagesha-Suba state forest using an experimental economics approach. The specific objectives are: to find out the mean willingness to pay of households to conserve the forest without any interventions, to explore WTP with intervention mechanisms of change in the level of deforestation and income before any awareness creation was made to the households regarding the severe consequences of deforestation, to experiment WTP of respondents with scenarios of change in the level of deforestation and monthly income after awareness creation; to compare and contrast the experiments made on the WTP of households before and after awareness creations and also between various interventions attain in the experiment, and to identify the major influential factor/factors that affect the WTP of the households using Tobit model.

This paper examines the factors that determine the WTP of the households in the Menagesha-Suba state forest. The study addresses the following research questions: What is the mean willingness to pay of households without any interventions? How much is the mean WTP of respondents in the Menagesha-Suba forest with the change in the level of deforestation and monthly income? How much is the WTP of households when the number of trees and income changed after awareness creation? What is the result when we compare the WTP of households before and after awareness creation and also between various interventions attain in the experiment? What are the major influential factors that affect the willingness to pay of households?

Literature review

Fuel wood gap theory, in the 1970s and 1080s, come up with the assumption that all wood energy demand of the society emanates from the public forests. The theory concluded that fuel wood consumption is the major cause of deforestation. But the theory is rejected through different

research that especially in Asia and pacific countries, fuel wood consumption is a local cause of deforestation moreover, cultivation of forest land for agriculture is the root cause of deforestation (FAO, 1997). The major Causes of deforestation might vary across countries.

The causes of deforestation in Ethiopia are explained by urbanization, expanding population pressure, demand for fuel wood, and agricultural cultivation. Lack of awareness of the negative consequences of deforestation in the community and failure to relate forestry policies with the overall development policy in the government makes the problem worse (Fekadu, 2015), (UNFCCC, 2016). In Ethiopia, continuous deforestation resulted in the loss of biodiversity, loss of habitat for animals and tree species and also soil erosion, climate change, and other related critical issues (Fekadu, 2015).

Some of the demographic factors that aggravate the decline in the coverage of forests are population growth, density, distribution, migration, and urbanization. Brazil, Australia, Indonesia, Nigeria, Tanzania, Zimbabwe, Congo, Myanmar, Bolivia, and Venezuela are the top ten countries with a high level of deforestation rate in the world. At the same time, those countries are with rapidly growing population rates. This result shows the strong relations between deforestation and population. The increase in food consumption demand parallel to high population growth leads to the deforestation of forestry lands for agricultural plantation purposes.

In most Sub-Saharan African countries, the high density of the population is required for the large number of fuel wood consumptions beyond the capacity of the available fuelwood supply. An increase in population density leads to migration. And this has also an adverse effect on forests. Especially in rural areas, as people are getting adults, they want to participate in agricultural productivity and generate their own income. This resulted in deforestation. Population pressure and migration are drivers of urbanization. The urban population in developing countries like Asia and Africa is expected to grow from 40% to 60%. Urbanization requires a large space of land and this also drives deforestation. A family planning program, to slow down the growing population and to have a healthier livelihood is indicated to minimize the deforestation rate (PAI, 2011).

The rapid growth of the population results in the over-exploitation of forest resources. Large numbers of the population consume a large number of fire woods and require more farmland for

agricultural cultivation (Fekadu, 2015). The study conducted in Southern Nations, Nationalities, and Peoples' Region Ethiopia, Gurage zone, in Wolkite, Selamber and Edgetber kebele shows that the scarcity of land resources with the overgrowing population pressure aggravated the problem of deforestation in the area (Mohammed, 2011).

Climate change is one of the challenges to human welfare and development. Deforestation and land degradation result in the emission of greenhouse gases which is a major cause of climate change (Robinson et.al, 2013). Forests observe the excess carbon dioxide from the atmosphere which reduces global warming which is an average increase of the earth's temperature. If forests could not observe the excess carbon dioxide, it will result in adverse climate change. Climate change is a factor for declining agricultural productivity, flood, and the spread of infectious diseases. In general, climate change severely affects economic growth (Aklilu et al., 2013).

Climate change is a global challenge. Therefore, different agreements are settled between countries. UNFCCC is the one which is held in Brazil, Rio De Janeiro, in 1992. The main focus of the agreement was on the environment and development. Climate change and greenhouse gas concentration in the atmosphere and responsible development with the great protection of the global environment was the agenda. Reducing emissions from deforestation and forest degradation (REDD) is one of a mechanism employed in 2005 to achieve the UNFCCC's objective. It was also an agenda in 2009, Copenhagen 15th conference of UNFCCC. The program was revised to REDD+ in consideration of capturing reduce emissions from deforestation and forest degradation, conversion, enhancement of forest carbon stocks, and sustainable management of forests. At the Copenhagen conference, developed nations agreed to release funds and support the program in developing countries (Farm Africa, 2010). African countries like Ghana, Liberia, Madagascar, Tanzania, Zambia, and others are implementing the program (Robinson et.al, 2013). The implementation in the South-Eastern Ethiopian highlands in Bale eco-region is an indication that Ethiopia is also applying the program (Farm Africa, 2010).

Deforestation is a global issue. It is affecting every part of the world. Countries are struggling with the problem in various ways. For instance, in Italy, forests provide ecosystem services. Such as soil protection and recreation. A survey was conducted in North Eastern Italy. The major objective of the study was to investigate preferences; uses and WTP of the Veneto community for ecosystem

services produced by regional mountain forests. Improving forest management from the perspective of society is important to secure the quality of forests and the environment. The study applied a choice experiment. The choice experiment helps to consider complex goods like environmental resources. Respondents can choose one alternative policy in a choice set. The study comes up with the result that the respondents have less awareness about ecosystem services. And even after the intervention and awareness creation to the society, they prefer to choose the less costly alternative. In general, the result of the survey shows that WTP is not significant for biodiversity conservation rather than for recreation purposes (Gatto et.al, 2014). For sustainable forest management, Ghana introduced new policies and interventions like the voluntary partnership agreement REDD program with the European Union.

VPA insures the importance of the local community's participation in the policies and interventions related to forest management. The survey conducted in the West region of Ghana, Subri forest come up with a result of mean WTP ($1.59-$1, 61 in 2009 exchange rate) per respondent to reserve the forest. Older and respondents with higher income are willing to pay more than the younger & lower income earners (Ansong & Raskaft, 2011). Côte d'Ivoire also has one of the highest deforestation rates in West Africa. Forests are degraded by around 300, 000.000 ha or 3.1% per annum.

The rapid growth of population and Poor definitions of property right replace the rainforests with agricultural land. Cultivation is the major cause of deforestation in the Ivory Coast (Beke, 2011). Rural peoples in Nigeria generate most of their income from non-timber forest products which include animal leaves, gum, ropes, fruits, and seeds. Those peoples account for 200 million in Asia and around 1 billion in the pacific. In South-Eastern Nigeria 35.7% of the rural households collect NTFP daily. Especially for women, this is an independent way of income earning. This resulted in degradation and poor conservation of forests. To control timber exploitation in Nigeria, afforest management committee has been organized with households. In the study conducted in the cross-river state of Nigeria, household size, wealth status, age, sex, and occupation are identified as the major influential factor of WTP. Using the Tobit model, the following results are found. Wealth category, occupation, number of years in schooling, and the number of females in the household positively affected the WTP. On the other hand, distance from the forest and male-headed households are negatively related (Chukwuone & Okorji, 2008).

Deforestation is also a critical issue in Ethiopia. A participatory forest management system is considered one of the mechanisms to deal with the problem. There are different articles and empirical evidences that have been conducted across the country. Some of the findings are revised as follows.

Households sometimes prefer to contribute labor for the conservation of forests. The survey conducted in Semen mountain national park, which is found in the Amhara region, North Gonder Zone can be taken as evidence. Data was collected using open-ended questionnaires and discussions with 5 groups from 96 randomly selected households. CVM and Heckman's two-stage models are used to calculate the respondents' WTP to reserve the park. All of the farmers were willing to contribute labor rather than cash, which is a WTP amount of 0. The study, come up with a result of an average WTP to reserve the park of 24 man-days labor per annum. The major factors that are pointed out to be considered for the successful and sustainable implementation of conservation strategy are age, perception of land degradation, income from tourist-related activities, and distance from the district's town and others are significantly related to their expected net loss (Bekabil & Anemut, 2000).

Using Contingent valuation of community plantations in Amhara regional state, particularly in east Gojam and South Wollo districts has shown that literacy is a significant factor of WTP for the preservation of forests. The survey covers 1,520 households from the two zones. The WTP data was collected using 5 starting prices (Which is a closed-ended question), followed by an open-ended question. In general, communities with existing plantation practices in their village have higher WTP compared to those who do not have the practice. But the women in a village without a plantation have a higher WTP mean than the men in their own village. The closed-ended question comes up with a higher WTP mean value for the plantation compared to the open-ended one. Since the result founds a wide range of variation in the annual aggregate WTP of the village, which is between Br.1, 301.00 to Br. 8,285.00. Though, Government and also other responsible bodies who are interested to maximize their contribution to welfare should give due attention to the selection of locations for the provision of community plantations in Ethiopia (Alemu, 2001).

The communities in Southern Nations, Nationalities, and people's regions, Wondo Wosha sub-catchment are concerned about the conservation of their local forests. The study conducted in the area with the main focus of defining the value and contribution of forests to the rural household economy and WTP of the community finds out that the mean WTP of households per year is E Br.30.30. Surprisingly, referring to their low-income level, 18% of the respondents agreed to pay nothing assuming that they have the right to use the land. But in general, the study concluded that the community, even the poor households are concerned about the conservation issues and are willing to contribute in terms of cash or labor to reserve the forest (Tefera, 2006). Population pressure, overgrazing, water, and soil degradation, and agricultural expansion are the major courses of forest loss in the Eastern part of Ethiopia, Dire Dawa. Like the previous studies, the survey tries to access the perception of the communities towards forest preservation and WTP in the area. A sample of 393 households was randomly selected. A face-to-face interview was a data collecting mechanism used. The econometric model applied was Probit and Tobit, economic models. Besides the identification of the above-mentioned factors as the main causes of deforestation in Dire Dawa, the study stated Br.94.09 as a mean value of WTP from the double-bounded election method. A total of Br. 2,026,604.51(1 US$=18.44Br.) per annum for 5 years and the mean value of WTP using open-ended election come up with a lesser amount which is Br.64.82.

Monthly income of the community, Initial bid perception, education level, ownership type, and access to expansion service are pointed out to be under consideration for community-based forest preservation (Alem, 2012). To capture the perception and the WTP of North Western Ethiopia, Dera district households to protect church forests, respondents are randomly selected from 20 forests and the model used to assess is Contingency Valuation Method (CVM) and Heckman econometric model. The study tried to capture their perception on the degradation of church forests and the associated loss of benefit and their WTP to preserve the forest. Age, formal education, Land ownership adjacent to the forest and generating income from those forest products are significant factors for their willingness to pay to reserve the forests. Formal education level is negatively related to their willingness to pay. The reason stated by the authors is that as their formal education level is increasing, rather than depending on the church forest products, they get access to job opportunities in formal sectors.

Those studies conducted in the Ethiopian context show the factors and the local community's WTP to preserve forests. The study is designed to fill the gap and capture the factor of changeable decision-making behavior of households through various intervention mechanisms**.**

Methods of the study and Design of the experiment

The experimental economics approach begins with a concern with the real identification of program effects in complex and multiple channels of causality (Banerjee & Duflo, 2009). It focuses on exploring individual behaviors. This study was conducted using an experimental economics approach. Data was collected using primary data collection methods. This includes questionnaires, discussions for awareness creation, interviews, and observation. In order to capture the WTP of the households which fall between zero and some other certain number, the Experimental economics approach, and the Tobit model were employed for the analysis purpose.

Design of the experiment: The survey was held in the West-Showa zone, Menagesha Suba state forest. In order to assess the WTP of the households in the area, 100 households are selected randomly. The randomly selected households fill a structured survey questionnaire. The questionnaire captures the respondents' socio-economic and demographic characteristics, like age, gender, income, and education level. Their perception regarding the significance of Menagesha Suba forest, the cause and effects of forest degradation, the participatory forest management system, and last but not least, their WTP to conserve the specified forest is captured by the questioner. Household's economic decision varies across different scenarios. An experiment was conducted on those randomly selected households using an experimental economics approach. The experiment was undertaken with intervention and without the intervention of the researcher. For simplicity, an ideal or artificial forest with the assumption of 100 trees was created. Households' age is unchangeable.

The change in the WTP of households is captured by the artificial change made on the level of deforestation and the households' income. In the experiment, the respondents' WTP was identified within two rounds. That is when the artificial forest is left with 80 trees, 60, 40, and 20 trees. Regarding the respondents' income, the household's WTP was experimented with the expectation of 10%- and 20%-income increment. This experiment was repeated after awareness creation was

made among the respondents about the consequences of deforestation. A focus group discussion was held among the households. The discussion was about the significance of forests, the immediate cause, and consequences of deforestation and land degradation, and also the role of the households in order to preserve their nearby forest. The second phase of the experiment was continued after awareness creation and intervention through a focus group discussion. The same questions were provided to the respondents. The data surveyed using the experimental economic approach to capture the WTP of the households to preserve the forest was analyzed using the Tobit model to identify the main influential factors.

Research Approach: In this research, both quantitative and quantitative research approaches are used. The Perception of households regarding forest and forest management is more explained by a qualitative approach. The analysis part is addressed using a quantitative research approach.

Sampling technique: 100 households who are living in the forest site are randomly selected from Suba woreda for the study of their willingness for forest management.

Source Data: In order to attain this study, a primary source of data is used. The primary source of data is used through questionnaires and a focus group discussion.

Analysis/Treatment of the data: After gathering of data through a questionnaire, Micro soft excel was used for coding, monitoring, verification, and management purpose of the data. The main objectives of the paper are analyses using STATA software.

Model Specification

Tobit Model: Tobit model is a limited dependent variable regression model which is developed by the Nobel laureate economist James Tobin in 1958. Based on the related literatures summarized, age, gender, level of education, distance from the forest, family size, and income are considered explanatory variables to determine the WTP of households in the Menagesha Suba forest. WTP of households is censored data in which a fraction of the observation on it takes a limit value of 0 for those who are not willing to pay and some positive number for those who are willing. As a result, a Tobit model which is also called a censored regression model has been applied. (Gujarati D. N., 2004). The standard Tobit model (Gujarati,2004), (Sun, Richard T.Carson and Yixiao, 2007)

$$y^{*}_{i} = \beta_1 + \beta_2 x_i + \epsilon_i$$

$y_i = 0$ if $y^*_i \leq 0$

$y_i = y^*_i$ if $y^*_i > 0$

Modified model: $WTPi = \beta_0 + \beta_1 G + \beta_2 Ag + \beta_3 Ed + \beta_4 D + \beta_5 FS + \beta_6 I + Ci$

Where:

WTPi: Willingness to pay households before and after awareness creation

i: Number of interventions (1 and 2)

WTP_1: Willingness to pay households before any awareness creation

WTP_2: Willingness to pay of households after awareness creation

β_0: Constant term/ intercept

G: Gender (Male or Female)

Ag: Age of respondent

Ed: Education level of respondents

D: Distance from the respondents' residence to the forest (in minutes).

FS: The total family size of respondents

I: Monthly income of respondents

β_1-6: Coefficients for the independent or explanatory variables accordingly that is,

(β_1 for G, β_2 for Ag, β_3 for Ed, β_4 for D and β_5 for FS and β_6 for I).

Ci: Unobserved random disturbance or error term.

Results and Discussions

Menagesha -Suba forest is found in West Ethiopia, Oromia region which is 40 km away from Addis Ababa. The forest is located within a longitude of 38°31'–39'E and latitude of 08°54'N–09°04'N (Desalegn & Wube, 2012). The altitude falls between 2,330 to 3,300 m a.s.l. The area has a yearly rainfall level of 1,100mm on average. The mean annual minimum and maximum level of temperature is 9.5°C and 22.5°C is the range in which the mean annual level of temperature is in the Menagesha Suba forest. The area has a yearly rainfall level of 1,100 mm on average. (MOA, 2002; Desalegn & Wube, 2012). From mid-June to the end of September is the rainiest season in the area. There is also a lesser rain between mid-April to May (Duguma et.al, 2009).

Around 31% of the households in the area live inside the forest site. Their economy is based on agriculture but the high rate of land degradation leads to a low level of agricultural productivity. This drives the community to depend on the nearby forest and its products (Duguma et.al, 2009). Menagesha Suba state forest is established by Emperor Zera Yacob (1434 -1468). The emperor arranged to plant Junipers from Wef Washa which is 190 Km North of Addis Ababa to the Menagesha –Suba forest. The oldest trees in the forest are more than 500 years. Though, it has been calling as 'The oldest park in Africa' (Larson, 2010). The formerly protected area of the forest used to be 9,248ha. But due to settlements, farmland, and grazing areas, only 2,500ha of the original forest was left with additional 1,000ha under plantation (MOA, 2002).

There are various types of trees in the Menagesha Suba forest. The majority of trees are tid (Juniperus procera-African pencil cedar). The biggest tree is above 50m tall and diameter of 2m. Zigba (Afrocarpus (podocarpus) falcatus-African Podo), Tikur Inchet (Prunus africanus- Red stinkwood or Iron wood) ,Kosso (Hagenia abyssinica) ,Weira (Olea europea subsp), Imbis (Allophylus abyssinicus) ,Qulqual (Euphorbia ampliphylla), Jibrra (Lobella gib-beroa) and also many other small trees and bushes are some of the trees that are found in Menagesha Suba forest (MOA,2002), (Duguma et.al, 2009), (Larson, 2010). Including the endemic animals Menelik's Bushbuck and White-footed rat, there are also 32 species of mammals and 186 species of Birds. Four of the bird species are endemic. Mole rats, Grass rat, Caracal, Serval cats, Leopard, Aardvark, White colobus, Abyssinian Hare, Bush Pig, and many more species of birds are found in the forest (MOA,2002), (Larson, 2010).

Descriptive Analysis

One hundred Households have been randomly selected to assess the Willingness to Pay (WTP) for forest conservation. The result revealed that 73% of the respondents are male where as 27% are female respondents. Their education level ranges from illiterate to a Degree holder. The average education level of the households is 3.19. On average their distance from the forest is 27.2 minutes. The households have family members with a maximum of 11. On average one household has 5 family members. The households in Suba village generate their income from various sources. The same as other rural households of the country, households in the study area depend on agriculture and activities related to the forest as a means of their livelihood. The mean income of the household from agriculture is Br. 1,438.84.

Menagesha- Suba forest administration also plays a great role in creating job opportunities for households. Most of them are leading their lives engaging as security guards of the forest on shift bases. Household that generates their income through employment in formal sectors including forest guarding account for nearly 33%. Agriculture turns out to be the second leading means of livelihood for rural households in the study area. On average, their income which is generated from agricultural products is Br. 2,074.77. This is evidenced by the fact that 29% of the respondents are engaged in agriculture. They mainly produce cereals namely wheat, teff, maize, barely, lintels, beans, etc. Almost all rural households, engaged in agriculture produce wheat and teff. Some households also engaged in pitty trades like selling firewood and charcoal from the forest and selling of alcohol and traditional drinks like 'Tela'.

Profile of Willingness to pay and forest conservation in the community

The fundamental factors that make people conserve the forest and be willing to pay for forest conservation depend on the extent to which the members of the community understand the importance of forests. In this regard, 71% of the respondents know that forests enable to have better climate conditions to the environment. 36% of the respondents also claimed that forests have the advantage for construction while 51% of the respondents again disclosed that forests are important for firewood collection. Forests use for the construction of household goods, agricultural tools shelters, and fences. 34% of the respondents describe it with other advantages (climate

conditions, firewood collections, and others), and only 2% specified construction purposes as the only advantage of forests. In general, 36% of the households pointed out construction as one of the advantages of forests. 51% of the respondents identified the source of firewood and charcoal as one of the advantages of forests. Out of 51%, 46% claim these advantages in relation to other uses of forests. Only 9% of the households have the perception that forests play a significant role for tourism and for a source of food and shelter for animals. More than half of the respondents specified firewood collection as one of the main advantages of the forest. During the survey, the households were asked whether they are collecting firewood from the nearby forest or not. Only 5% of the respondents do not have the practice, whereas the rest 95% of them collect firewood. Out of the 95% of respondents who collect firewood, 81% of them collect and use the firewood for consumption purposes. Only 5 % of the households collect firewood for dual purposes, like for consumption and production of charcoal, or else for daily consumption and providing to the market. The rest 9% of the households who collect firewood, use it for consumption, for preparation of charcoal, and to sell to other users.

During the transition period from the Derg regime to EPDRF in 1983 E.C there was a high rate of deforestation. Currently, there is a better controlling mechanism for the Menagesha- Suba forest. But the deforestation rate of the forest is increasing. Regarding the current condition of the forest, 98 % of the households believe that the forest is degraded. 2% of the respondents argue that the forest is in a good condition and is not degrading.

Causes of Deforestation

Households who live around Menagesha –Suba forest specified various factors as the major causes of deforestation in the area. Economic factors like unemployment, low level of income, and poverty, in general, took the lion's share of the cause for deforestation in the Menagesha-Suba forest. This is pointed out by 59% of the respondents. Others blame the controlling mechanism of the forest administration for deforestation. The weak controlling mechanism of the forest administration is identified by 17% of households as the major cause of deforestation.

There are three actors which are mentioned to take responsibility for deforestation in the Menagesha Suba forest. About 47% of the respondents claim the government is the responsible body for the degradation of the forest while 25% mentioned that the community itself is the responsible organ for such end. The rest 28% claimed that both the Government and the community are the responsible agents for degradation.

Deforestation has various adverse consequences. About 97% of the respondents identify climate change as the major consequence of deforestation. Climate change is a factor in declining agricultural productivity, flood, and the spread of infectious diseases. It severely affects economic growth (Aklilu, 2013). Climate change also leads to poverty but only 5% of the households put poverty as the consequence of deforestation. Only 1 of the respondents could not identify the main consequence of deforestation.

The households in Menagesha Suba forest specified the major agents who can minimize the deforestation rate in the area. Although they identified the government as the main responsible body for deforestation, the respondents also claim that the government should play a great role to minimize deforestation. This counts 23% of the respondents, which is higher than those who pointed out the community, (20% of the households) as the main agent contributing to deforestation. But half of the respondents believe that both the government and the community should work together for decreasing the rate of deforestation in the Menagesha Suba forest. There are also 2% of the respondents who trust the Non-Governmental Organizations than the government and the community for minimizing the rate of deforestation in the area.

Willingness to Pay (WTP) of Households

As per the survey conducted in the Menagesha-Suba forest, 94% of the households are very much concerned about the degradation of the near bye forest and believe that the participation of the community is very much important to conserve the forest. Out of the households who are concerned about degradation, 92% are willing to pay for the conservation of Menagesha- Suba forest. The rest 6% are somehow concerned about the degradation and their role to conserve the forest but not as strongly as the majority. As a result, they are not willing to pay for the conservation of the forest. In general, including 2 respondents who are very much concerned but not willing to pay, 8% of the respondents are not willing to pay for the conservation of Menagesha –Suba forest.

Households were asked in what way they are willing to pay for the conservation of the forest. 32% of the respondents are willing to pay in terms of cash. Considering their low level of income, most of the respondents, which count 56%, prefer to make their contribution in labor hours. The rest 4% are willing to make their payment both in terms of cash and labor. The respondents who are willing to pay in terms of cash range from a minimum of Br.5.00 up to Br.400.00 .On average, they are willing to pay Br.22.11 per month. For applying the same measuring units, the willingness to pay in terms of labor hours is converted to Ethiopian birr. During the survey, six different amounts of payment for the daily laborer on the site are identified. Those are Br50, Br40, Br36, Br35, Br. 30 and Br. 27 per day. The mean labor value in the study area is Br36.30 per day. Considering 8 working hours per day, the value of labor per hour is Br 4.54. As a result, the labor hour that the respondents are willing to contribute to the conservation of the Menagesha-Suba forest is converted accordingly. Though, they are willing to contribute with a minimum of Br2.27 to Br.290.56. Br50.21 is the mean contribution of labor hours in terms of cash by the households.

Experiment 1- WTP with Intervention

In order to capture the dynamic behavior of households toward their willingness to pay for the conservation of forests, an experiment was made using different scenarios. As it was clearly explained in the design of the experiment section, an ideal or artificial forest, for simplicity, with the assumption of 100 trees is created. In the following sections, the comparison in the willingness

to pay of households with the intervention made by changing the level of deforestation and households' income is explained.

WTP when the number of trees decreases without intervention through awareness creation.

The first experiment that was made during the survey was checking the variation in the willingness to pay of households when the level of trees declined because of deforestation. As the level of trees decreases from 100 to 80, the households are willing to pay Br. 21.15 per month. Additional 20 trees are removed from the forest and left with 60 trees, at this time; respondents add Br3.21 and are willing to pay Br24.36 on average. When the forest is with 40 trees, the survey comes up with a result of a mean willingness to pay Br27.57 per month. Assuming that, the level of deforestation rate increases and 80 trees are deforested; the mean willingness to pay to conserve the forest is Br.30.39

There are also more respondents who are willing to conserve the forest through the contribution of their labor hours, than in cash. On average, those respondents are willing to pay Br.71.09 per month as the level of trees declines to 80 trees. When the level of trees is decreasing from 80 to 60, 40, and 20 trees, the average willingness to pay of households in labor hours is Br93.84, Br116.59, and Br138.42 respectively. Considering their low level of income, the majority of households prefer to contribute their labor hours than pay in terms of cash. This leads to a higher WTP in terms of labor hours than in cash. In general, the result clearly shows that, as the level of deforestation rate increases, the willingness to pay that the households are willing to contribute both in terms of cash and labor increases.

WTP when the Income of the household increase by 10%

The mean willingness to pay of households as their monthly income is increased by 10% and at the same time when the level of trees declines from 100 to 80 trees is Br.33.6 in cash. This is 58.87% higher compared to the base willingness to pay, that is before any increment of income. Within the same scenario, the households' WTP in labor hours is Br.96.01 per month. The change in their willingness to pay in labor is higher than the percentage of their income increment, which is 35.05%. Considering 10% increment on the household monthly income, as the level of deforestation increases from cutting 20 trees to 40 and 60 trees, the respondent's willingness to

pay is Br38.51 and Br42.41 in cash and Br118.32 and Br.140.91 in labor hours respectively. In general, with the increment of income of 10%, the willingness to pay of households is more than 10% compared to the base WTP of households. At the same time, the willingness to pay respondents both in cash and labor hour bases increases with the increase in the level of deforestation. The result of t-tests also shows that there is a significant mean difference between the base willingness to pay of households and their contribution when 10% is added to their income. This is true in their WTP both in cash and labor hour.

Table 1

WTP When the Income of The Household Increase by 10% (with Assumption: Artificial Forest With 100 Trees)

No. of Trees	Average WTP per month In Cash (Br)			Average WTP per month in Labor hr.(Br)		
	Base WTP	**Income Increases By 10%**	**T test**	**Base WTP**	**Income Increases By 10%**	**T test**
80	21.15 (44.08)	33.60 (78.57)	0.0079	71.09 (102.53)	96.01 (127.98)	0.0000
60	24.36 (53.81)	38.51 (91.90)	0.0161	93.84 (132.82)	118.32 (160.96)	0.0000
40	27.57 (65.34)	42.41 (102.95)	0.0357	116.59 (169.84)	140.91 (198.87)	0.0000
20	30.39 (78.13)	46.46 (116.17)	0.0513	138.42 (209.54)	164.51 (238.29)	0.0000

Notes: the values in the bracket indicate standard deviation.
Source: Survey result.

WTP when the Income of the household increases by 20%

The other scenario that is undertaken during the experiment is to test the willingness to pay of households when the level of income further increases to 20%. As the level of trees decreases from 100 to 80 trees due to deforestation, respondents are willing to pay Br. 49.81 in cash and Br. 115.37 in labor hours. The willingness to pay in terms of cash is 48.24% higher than WTP in 10% increment of income and 135.51% more compared to the base willingness to pay. That is the WTP before any change in income. Since the change in the monthly income of a household is directly related to the availability of cash on hand, the contribution of households with the change in income is higher in terms of cash than labor. The monthly willingness to pay of households as the level of trees decline from 80 to 60, 40, and 20 trees and their income increases by 20% are Br53.57, Br56.24 and Br59.40 in cash and Br135.53, Br158.77 and Br179.51 in labor respectively**.**

WTP when the Income of the household is constant

Respondents' WTP for various levels of deforestation with the same and constant income has been experimented. The mean willingness to pay of households with a constant Br. 1,000.00 monthly income and when the artificial forest is 80 trees is Br38.04 in cash and Br80.63 in labor hours. There is a slight decline of 0.36 cents in mean WTP in cash when additional 20 trees are deforested. In this case, the households are willing to pay Br99.30 on monthly bases for labor hour contribution. When additional 20% of trees are deforested from the forest and left with 40 trees, the households are willing to pay additional 7.78% of cash from what they were willing to pay when 40 trees are deforested from the artificial forest. Due to the low level of income in the community, the households are willing to contribute more hours of labor than paying for the conservation of the forest in cash. As a result, the percentage increment of labor hours with additional 20% deforestation of trees from the forest is higher than the contribution in terms of cash.

During the survey, the assumed Br. 1,000.00 constant monthly income was considered a higher income than the income that they actually earn. This belief was held especially among those who are not engaged in formal sectors. With this expectation, they are willing to pay more cash than the base WTP. But since the mean monthly income of the respondents is almost close to the assumption, there is no significant mean difference between their willingness to pay with their actual income and with the monthly income of Br1,000.00.

Experiment – 2 WTP of households with intervention and awareness creation.

This is the second phase of the experiment. In this section, the respondents' willingness to pay was captured with additional intervention mechanisms of awareness creation through discussions about the severity and adverse consequences of deforestation. In order to capture the change in the willingness to pay of households, the same experiment was undertaken after another intervention mechanism of awareness creation with the change in the level of trees and monthly income.

WTP of households after awareness creation

In the second phase, 92% of the respondents are again willing to pay for the conservation of the forest. This is the same figure as the result in the first experiment. But there is an increment in their willingness to pay to conserve the forest both in cash and in labor hours. The mean willingness to pay of 32 households, who are willing to contribute in terms of cash is Br28.95, which is Br6.84 higher than in the first experiment. In the case of labor contribution, the respondents are willing to contribute 4% more of their labor after intervention through awareness creation.

WTP When the number of trees decreases after awareness creation

The mean willingness to pay of households increases when the level of trees decreases after awareness creation was made regarding deforestation. The average willingness to pay of respondents is Br. 29.80 in cash and Br. 72.22 in labor. This is when 20 trees are deforested from the assumed 100 trees. Compared to experiment I, there is an additional Br. 8.65 willingness to pay in cash. The t-test also implies that the awareness creation regarding deforestation has a significant impact in the mean WTP of households in cash as the forest is left with 80 trees. As the level of trees declines from 80 trees to 60 and 40, the respondents are willing to contribute Br32.51 and Br34.67 in cash and Br94.61 and 115.95 in labor hours respectively. In general, the willingness to pay in terms of labor hours converted to birr is higher than in cash and the contribution both in labor and cash are increasing as the level of deforestation rate decreases and as the number of trees decreases. But there is no significant mean difference between experiment one and experiment two average WTP of households per month, except in case of willingness to pay in cash when there are 80 trees in the forest.

Income of the household increases by 10% after awareness creation

This is an experiment made with double interventions. Besides the change in the level of trees, there is an intervention made through awareness creation and a 10% increment in the monthly income of households. In this scenario, the respondents' willingness to pay when 80 trees are deforested from the forest is Br51.52 in cash and Br155.20 in labor hours. The labor hour contribution when only 20 trees are left in the forest is 201.24 % higher than in the cash. Since the respondents are more willing to labor hour contribution than in cash, there is a higher difference between the two terms.

WTP in cash after awareness creation and a 10% income increment to the respondent is Br. 41.42, Br. 44.89, and Br. 47.73 when the number of trees is 80, 60, and 40 trees accordingly. On the other hand, for the same scenario, the households' contribution to the conservation of the forest in labor hours is Br.93.69, Br.114.26, and Br.136.41. The amount of willingness to pay increases as the level of trees declines and there is a significant mean difference between the second base WTP and on a willingness to pay after awareness creation and a 10% income increment. But there is no significant mean difference between a WTP of 10% increment in a monthly income before and after awareness creation to the households.

Table 2 WTP when the Income of the household increases by 10% after awareness creation.

No. of	Average WTP per month in terms of Cash (Br.)						Average WTP per month in terms of Labor hr. (Br)					
	Base WTP (2)	Income Increase	T test	Experiment I	Experiment II	T test	Base WTP (2)	Income Increases	T test	Experiment I	Experiment II	T-test st
80	29.80 (70.21)	41.42 (97.84)	0.0003	33.60 (78.57)	41.42 (97.84)	0.2583	72.23 (106.99)	93.69 (132.70)	0.0000	96.01 (127.9	93.69 (132.70)	0.5258
60	32.51 (76.36)	44.89 (103.43)	0.0002	38.51 (91.90)	44.89 (103.43)	0.3975	94.61 (136.02)	114.26 (162.8	0.0000	118.3 (160.9)	114.26 (162.8)	0.3021
40	34.67 (80.84)	47.73 (107.43)	0.0002	42.41 (102.95)	47.73 (107.43)	0.5139	115.95 (172.59)	136.41 (200.1)	0.0000	140.91 (198.8)	136.41 (200.1)	0.3016
20	36.72 (86.58)	51.52 (117.18)	0.0002	46.46 (116.17)	51.52 (117.18)	0.5758	137.97 (211.99)	155.20 (231.4	0.0015	164.51 (238.2)	155.20 (231.4)	0.1034

WTP when the Income of the household increases by 20% after awareness creation

An increase in WTP of households as the level of deforestation rate increases also appears in an experiment made on the willingness to pay of respondents with an intervention of awareness creation and a 20% monthly income. Considering the household's stored knowledge about the severity of deforestation, they were willing to pay Br21.15 in cash. And there is a significant increment or change in their willingness to pay after awareness creation. Which is Br 29.80. This result is obtained with the assumption of 80 trees left in the forest. As the experiment goes to increasing 20% of their monthly income after awareness creation, respondents are willing to pay Br 61.12 in cash. This result has a significant mean difference compared to WTP after awareness creation but with no change in the monthly income of the households. This verifies that 20% income increment has a significant change in mean WTP after intervention. As the level of deforestation increases from cutting 20 trees to 40 and 60 trees, respondents are willing to pay Br 62.97 and Br 66.37 in cash when income increases by 20% after awareness creation. In comparison, an additional 20 % made on the monthly income of households after awareness creation has a significant impact on the mean willingness to pay of respondents compared to the second base willingness to pay. That is a willingness to pay households with a change in the number of trees after awareness creation. On the other hand, awareness creation has no significant impact on the average WTP of respondents as there is a 20% increment in their monthly income.

There are 56 respondents who are willing to contribute labor hours for the conservation of the forest. When 20% increment is made on those households' monthly income, They are willing to pay Br. 110.42, Br. 131.89, Br. 152.78, and Br. 172.16 as the forest is with 80, 60,40, and 20 trees respectively. This willingness to contribute is come up after awareness creation was made among the respondents. There is an increase in WTP of households in labor hours as the level of trees is declining from the forest. The 20% income increment has a significant impact on the mean WTP of households in labor hours compared to WTP after awareness creation. But unlike the willingness to pay in cash, the respondent's WTP is lower than WTP with 20% income increment with no awareness creation in experiment one. There is also no significant relation between the mean WTP of households in labor hours with a 20% income increment before and after awareness creation.

Table 3 WTP when the Income of the household increases by 20% after awareness creation. Assumption: Artificial

No. of	Average WTP per month in terms of Cash (Br.)						Average WTP per month in terms of Labor hr. (Br)					
	Base WTP (2)	Income Increase	T test	Experiment I	Experiment II	T test	Base WTP (2)	Income Increases	T test	Experiment I	Experiment II	T-test
80	29.80 (70.21)	61.12 (154.18)	0.0022	49.81 (130.56)	61.12 (154.18)	0.1483	72.23 (106.99)	110.42 (154.98)	0.0000	115.37 (153.92)	110.42 (154.98)	0.3167
60	32.51 (76.36)	62.97 (156.58)	0.0025	53.57 (140.10)	62.97 (156.58)	0.2233	94.61 (136.02)	131.89 (186.91)	0.0000	135.53 (185.19)	131.89 (186.91)	0.4584
40	34.67 (80.84)	66.37 (160.57)	0.0018	56.24 (143.89)	66.37 (160.57)	0.1930	115.95 (172.59)	152.78 (222.36)	0.0000	158.77 (221.90)	152.78 (222.36)	0.2875
20	36.72 (86.58)	70.02 (165.87)	0.0013	59.39 (148.75)	70.02 (165.87)	0.1792	137.97 (211.99)	172.16 (255.75)	0.0000	179.52 (256.90)	172.16 (255.75)	0.2228

The values in the bracket are standard deviation

Source: Survey result

WTP when the Income of the household is constant after awareness creation.

With the assumption of the same or constant income to all households, which is Br. 1,000.00, the respondent's willingness to pay in terms of cash is more after awareness creation was made to the society regarding the Severe consequences of deforestation. In comparison to experiment one, that is the willingness to pay of households with a constant income before any awareness creation. WTP in Experiment two is higher. When the level of trees is 80, households are willing to pay 13.83% more cash than they were willing to pay before awareness creation. As the level of deforestation increases, respondents are willing to pay 18.55%, 22.95%, and 27.44% more cash than they are willing to contribute with their stored knowledge regarding deforestation when trees in the forest are 60, 40, and 20 trees respectively. The T-test result also shows that there is a significant mean difference between WTP with constant income before and after intervention through awareness creation when the forest is left only with 40 and 20 trees. Unlike households WTP in cash, there is a percentage fluctuation in willingness to pay with increased deforestation rate. When the forest is with 80 trees, respondents are willing to contribute 0.23% more labor hours after awareness creation. This is lesser than they were willing to add in cash after awareness creation. Relatively, in the case of only 20 trees left in the forest, the household WTP is even 3.16% lesser than experiment one. In general, there is no significant mean difference in average WTP in labor hours and constant income before and after intervention through awareness creation in all scenarios.

When we compare the mean willingness to pay of households with constant income after awareness creation with the second base WTP, there is no significant relation in the case of labor contribution. Whereas, in the case of cash contribution, there is a significant mean difference in all scenarios except that 60 trees are available in the forest.

Table 4- WTP when the Income of the household is constant after awareness creation. Assumption: Artificial forest with

No. of Trees	Average WTP per month in terms of Cash (Br.)						Average WTP per month in terms of Labor hr. (Br)					
	Base WTP (2)	**Income = 1000**	**T test**	**Experiment I**	**Experiment II**	**T test**	**Base WTP (2)**	**Income = 1000**	**T-test**	**Experiment I**	**Experiment II**	**T-test st**
80	29.80 (70.21)	43.30 (104.87)	0.0589	38.04 (95.43)	43.30 (104.87)	0.3155	72.23 (106.99)	80.82 (127.99)	0.2783	80.63 (126.55)	80.82 (127.99)	0.9642
60	32.51 (76.36)	44.67 (110.15)	0.1096	37.68 (91.30)	44.67 (110.15)	0.1997	94.61 (136.02)	101.07 (154.76)	0.3622	99.29 (151.90)	101.07 (154.76)	0.3499
40	34.67 (80.84)	49.93 (114.39)	0.0607	40.61 (94.99)	49.93 (114.39)	0.0905	115.95 (172.59)	119.68 (184.19)	0.6262	118.93 (181.64)	119.68 (184.19)	0.7057
20	36.72 (86.58)	54.89 (119.18)	0.0427	43.07 (99.32)	54.89 (119.18)	0.0532	137.97 (211.99)	133.17 (203.22)	0.6326	137.52 (213.34)	133.17 (203.22)	0.4060

Factors affecting WTP of households

The Willingness to pay households is affected by various factors. Sex, Age, Education level, Distance from the forest, and Income are hypothesized as influential factors for WTP for forest management. Exploring the Willingness to pay scenario has two stages. Identifying respondents who are and who are not willing to pay followed by an analyzing experiment of their WTP with different interventions. Heckman Selection model (two steps) helps to avoid problems related to sample selection bias. It offers a means of correcting for none randomly selected samples and it also helps to find a result related to two steps factors, like WTP. The STATA result using the Heckman selection two-step model showed that the inverse mills ratio is insignificant for using the model for this data analysis. As a result, a Tobit model is applied to explain the matter.

Dependent Variable: Willingness to pay households to conserve the forest is the dependent variable for this study. The respondent's WTP before and after awareness creation regarding the severe problem and consequences of deforestation is experimented in consideration of various influential factors.

Independent Variables: Out of various factors that influence the WTP of households, sex, age, education level, distance from the forest, and Income are selected to study willingness to pay.

Gender: It is used to identify female and male respondents during the survey. The social, economic, cultural, and also perception difference between the two genders is taken as one factor that can influence their willingness to pay.

Age: It refers to the age of the respondents at the time of data collection. People feel responsible as their age increases. It is expected that people will be willing to pay more as they get older.

Education level: This variable describes the education level of respondents at the time of the survey. It was hypothesized that the educational background they have matters in their perception of the forest and their willingness to pay for conservation.

Distance from the forest: Even though, the respondents are from Suba, the distance from their residence to the Menagesha Suba state forest is different. It is expected that, the closer they live to the forest, their dependence on the forest and their willingness to pay also increases. During the survey, the distance from the respondents' residence to the forest is measured by the minutes it takes to travel to and from the forest.

Family size: Family size stands for the number of members in the family. The survey result showed that the maximum and average number of family size is 11 and 5 respectively.

Income: Income stands to represent the monthly earnings of the respondents. Most of the households in Suba earn their income from agriculture, petty trades, and most importantly from the Menagesha Suba state forest. It is hypothesized that the income of the households influences the WTP of the respondents.

Related tests and Tobit Model regression result for factors affecting WTP of households

James Tobin, who is the Nobel laureate economist, develop the Tobit model. Since the dependent variable (i.e. WTP) falls between 0 and some positive number, the model is also sometimes called a censored regression model or limited dependent variable regression model (Gujarati D. N., 2004)

Tests

Multicollinearity refers to the correlation or exact linear relationship between some or all independent variables. In the presence of multicollinearity, there will be a large variance and co-variance in the regression model resulting in, the coefficients of the explanatory variables not being estimated accurately. It can be detected using VIF or variance inflating factor. It shows how the variances of explanatory variables are inflated due to the multicollinearity problem. If the VIF coefficients of explanatory variables are above 10, it indicates that there is multicollinearity in the model. In our case, The VIF result in Table 5proves that the data used for this study has no multicollinearity problem. (Gujarati D.N, 2004).

Table 5

Multicollinearity – Variance Inflating Factor

Variable	**Sex**	**Income**	**Education Level**	**Age**	**Family Size**	**Dist. From The forest**	**Mean VIF**
VIF	1.32	1.26	1.22	1.18	1.09	1.05	
1/VIF	0.76	0.79	0.82	0.85	0.92	0.95	**1.19**

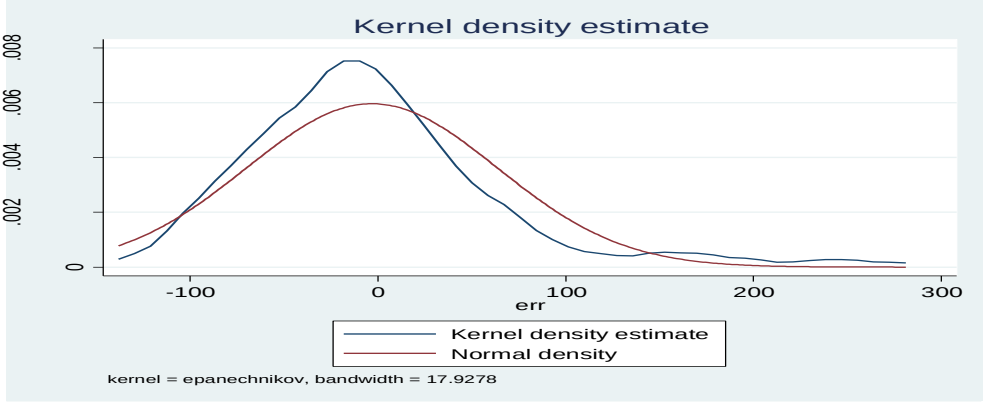
Source: Own Estimation

Heteroscedasticity: is the assumption of constant variance. The variance of an error term in the regression model should have a constant variance. If this assumption does not hold true, the data faces a heteroscedasticity problem (Williams R., 2015). The heteroskedasticity problem can be overcome by a Robust estimator (Rand R. Wilcox, 2000)**.** To avoid this problem a Robust test is already applied in the data. As a result, it is proved that there is no heteroskedasticity problem in this regression.

A normality test: The validity of estimation in the Tobit model relays on the assumption of normality (Jeong, 2010). The normality test assumes that the disturbance or error term has a normal distribution or the mean of residual is zero. In the figure below, the Kamel density estimate shows that the shape of the histogram is exactly bell-like confirming that residuals are normally distributed about its mean, which is zero. Though, the density of error term for this specific study has a normal distribution.

Figure 1

Normality Test



Source: Own Estimation

Tobit Model regression results for factors affecting WTP of households

The Tobit model regression result indicates that as respondents become one year older, their willingness to pay to conserve the forest decreases by Br.1.04 both before and after awareness creation. Increasing one level in education of households results to increments of Br.4.03 in WTP before and Br.4.73 after awareness creation. There will be a Br.0.23 increment in WTP when the

residence of the households is one more minute close to the forest. Regarding family size, as the number of families increases by a person, their WTP to conserve the forest will increase by Br.7.34.WTP increases by Br.0.02 as income increases by 1 birr. This verifies that the level of education; family size, and income are directly and the age of respondents and distance from the forest are inversely related to the mean willingness to pay of respondents. The Tobit model regression result with a 95% confidence interval shows that out of the six explanatory variables that are hypothesized to influence the willingness to pay of households, Age, Family size, and income are pointed out as significant factors to affect the WTP of households. Household becomes a year older, his/her willingness to pay for forest conservation decline by Br.1.04 in both cases.

When a household becomes older he becomes weak and his ability to contribute to labor will be less. In old age, people might be less willing to pay for the conservation. Moreover, older people mostly have their own resources like farmland and livestock which make them less dependent on the forest and therefore motivate them less to pay for its conservation (Bekabil Fufa and Animut Belete, 2000; Adugna Lake Tiruneh, 2013). Family size refers to the total number of households in the family. It is also one of the significant variables that positively affect the willingness to pay households. This variable is the only significant variable of WTP after awareness creation was made to the households. When a single member added in the total family size of the households, the mean WTP increases by Br.7.34. This result is before any awareness creation regarding deforestation was made and it has Br.3.15 increments after attaining the discussions.

Households having more children and family members will be more concerned about the future generation, WTP for the conservation of the forest is one way of reserving the forest for the next generation. So, they will be willing to pay more as their family size increases. (Alemtsehay, 2010). Households' monthly income is also one of the significant and positively related variables with WTP of households. This result holds if there is no intervention to create awareness about forest conservation. One Br. Increments in the income of the household results in Br.0.02 increments in the mean WTP. As explained in earlier sections, most of the households' source of income is directly or indirectly related to the Menagesha Suba forest. It is obvious that as the income they generate from it increases; they become motivated and more willing to pay for and to conserve the forest (Bekabil, 2000; Alemu, 2011).

Table 6

Tobit Model Regression Results for Factors Affecting WTP Of Households

Factors Affecting WTP	WTP Before intervention (Awareness creation)			WTP After intervention (Awareness creation)		
	Coefficient	**t**	**P>(t)**	**Coefficient**	**t**	**P>(t)**
Sex	9.06	0.6	0.55	23.40	1.31	0.22
Age	-1.04	-2.28	0.025	-1.04	-1.25	0.194
Education Level	4.03	1.57	0.120	4.73	1.29	0.200
Distance from The forest	-0.23	-0.49	0.628	0.40	0.42	0.67
Family size	7.34	3.17	0.002	10.49	2.8	0.006
Income	0.02	2.34	0.021	0.02	1.49	0.14
Constant	34.79	1.38	0.170	0.95	0.02	0.985

Source: STATA

Conclusions and Recommendations

The Majority of the households is very much concerned about the degradation of their near bye forest (94%) and believe that their participation is very much important for the conservation of the forest. 92% of the households are willing to pay for the conservation of Menagesha- Suba forest. The rest 8% are not willing to make any contributions. This result is true both before and after awareness creation was made to the households regarding deforestation. This implies that households already have enough awareness regarding the degradation of forests and its severe consequences. Due to the low level of their monthly earnings, households prefer to make their contributions in terms of labor hours than in cash. The mean WTP was found to be Br. 50.21 (56% of respondents) in labor hours and Br 22.11 in cash (32%).

The experiment which assumed 100 artificial trees showed that, as the level of deforestation rates increases or as the number of trees in the forest declines, the WTP of households increases both in cash and in labor hours. The severity of deforestation in the forest leads the households to be aware and concerned and pay more. This is also true in the case of 10% increments in the monthly income of households (Experiment 1). As 10% is added to their income, respondents become more responsive to the income increments and become willing to pay more than 10%, which is a significant change compared to the first base WTP scenario. 20% increment in monthly income has also a significant WTP change compared to the base WTP. Since the change in the monthly income of a household is directly related to the availability of cash on hand, the contribution of households with the change in income has more change in terms of cash than in labor. In the case of constant income assumptions that is Br1000, households especially those who are not engaged in formal sectors assumed that it is a higher offer of income than they actually earn. With this expectation, they are willing to pay more cash than the base WTP. But since the mean monthly income of the respondents is almost close to the assumption, there is no significant difference between the mean WTP they earn in their actual income and the mean WTP if they earn a monthly income of Br. 1,000.

The WTP after awareness creation (experiment-2) was found to be Br. 28.95 in cash and Br. 52.22 in labor. This figure is somehow higher than the result in experiment 1 but there is no significant mean difference between the two results. The second base is the WTP. Since the income of Br1000 is close to the mean monthly income of the households, what makes them sensitive to pay is the high rate of deforestation. A 20% addition to monthly income after awareness creation has a significant mean difference compared to the second base WTP but is insignificant compared to the result in experiment 1. That is the WTP of households with 20% income increments and without any awareness creation). This is true in both cash and labor-hour contributions. This shows that a 20% (higher) income increment increases the willingness to pay the households. However, the stored knowledge regarding deforestation made their WTP unresponsive to the awareness creation interventions. Poverty and low level of income in the society make the households in Menagesha –Suba state forest to be more willing to pay for the conservation of forests in terms of labor hour contribution than in cash.

Tobit model regression result has shown that out of the hypothesized factors that influence WTP, age, total family size, and income are pointed out as significant factors affecting WTP. Income and family size have a direct relation with the willingness to pay of households. However, the age of the respondents is inversely related to the change in WTP. As the income that the households generate from the forest increases, the households become motivated and more willing to pay for the conservation of the forest. In old age people mostly have their own resource which makes them less dependent on the forest and there their age does not encourage them to pay for the conservation. The larger the family size of households the more they will be concerned about future generations, WTP for the conservation of the forest is one way of reserving the forest for the next generation. Therefore, households will be willing to pay more as their family size increases.

Based on the study and the result attain in the Menagesha-Suba state forest regarding households' willingness to pay for forest conservation, the following recommendations are forwarded. The experiment which is attained in two rounds proves that awareness creations have no significant effect on the willingness to pay households to conserve the forest in the woreda. Income increments on the other hand have a large effect on households' WTP. Respondents pointed out unemployment, low level of income, and poverty as the major causes of deforestation in the area. This implies that rather than giving excess budget and attention to educate society regarding deforestation and related issues, the government should focus on allocating the budget to improve the living standard of the households is recommended. Since the community is highly dependent on agriculture, agricultural production should be improved through various packages in order to increase the income and improve the livelihood lively hood of the society. At the same time, facilitating various job opportunities to the youth like micro and small enterprise packages by facilitating training, loan, and working places will help to empower and to find other sources of income than degrading the forest to generate income. Doing so can increase the income of the community and therefore their willingness to pay more for the conservation of the forest.

The lack of a strong controlling mechanism by the forest administration is the second major cause of deforestation in the Menagesha-Suba state forest. Respondents also blame some corrupt guards who are employed to secure the forest but who help those participants in deforestation. This is also related to the low level of income and lack of responsibilities of the guards. As a result, it is

recommended that the forest administration builds the capacity of guards and also motivate them through salary increments, providing various facilities like providing consumption goods, education opportunities, insurance covers, bonuses, and also other employee's motivation mechanisms so that they feel ownership of the forest and protect it without any fraud. In addition to this, giving the opportunity to guards to generate additional income by allowing them to guide researchers, and local and foreign tourists could be another solution to improve their earnings and living standards. Such a strategy can also help to build honesty and a source of ownership among the guards. The finding of the study proves that the households are very much concerned and are willing to pay for the conservation of the forest. Therefore, there must be an organized, annually scheduled practice to motivate the participation of the community in the protection of the forest. Participating the community in cash and labor contribution in planting nursery plants, especially those of endangered species like Wanza, Zigba, Koso, Tikur enchet and abesha tid and others play a significant role in actually enrolling the households and also conserving the forest.

This study has tried to assess the WTP of households in the Menagesha- Suba forest and the factors that affect it across different scenarios. Forests are life to the generation and its degradation has an overall impact on the country. As a result, it is recommended that further research with a wider scope be undertaken. That is, with the extension of sits, with further relaxation of experiments considering other influential factors and capturing the dynamic willingness to pay of households. Even exploring the major causes of deforestation and other possible remedies to protect the forest for current and future the generation requires further exploration.

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